Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal Form

Section 1. General administrative information

Hungry Horse Dam Mitigation - Watershed Restoration and Monitoring

Bonneville project number, if an ongoing project 9101903

Business name of agency, institution or organization requesting funding
Montana Fish, Wildlife and Parks

Business acronym (if appropriate) MFWP

Proposal contact person or principal investigator:

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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
All Terrain Excavating, Inc. or other Heavy Equipment Contractor	P.O. Box 1307	Polson, Montana 59860	Bruce Newby
University of Montana	Biology Dept.	Missoula, MT 59812	Dr. Robb Leary
*Confederated Salish and Kootenai Tribes	P.O. Box 278	Pablo, MT 59855	Joe DosSantos
*MFWP - Hungry Horse Dam Wildlife Mitigation Program	490 N. Meridian	Kalispell, MT 59901	Alan Wood
*MFWP - Hungry Horse Reservoir Excessive Drawdown Mitigation Program	490 N. Meridian	Kalispell, MT 59901	Rick Malta

* Joint sponsors on certain individual projects. See section 3 below.

NPPC Program Measure Number(s) which this project addresses.

10.1B, 10.1C, 10.3A.1-4, 10.3A.6-8, 10.3A.10-13, 10.3A.17

NMFS Biological Opinion Number(s) which this project addresses.

Bull Trout Proposed ESA Listing (62 FR 32268)
Westslope cutthroat trout recovery actions
NMFS hydrosystem operations for salmon recovery (56 FR 58619; 57 FR 14653)

Other planning document references.

PLANNING DOCUMENTS: Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam (MFWP & CSKT 1991), Hungry Horse Dam Fisheries Mitigation Implementation Plan (MFWP &CSKT 1993), Fish Passage and Habitat Improvement in the Upper Flathead River Basin (Knotek et al. 1997) Montana Bull Trout Restoration Plan (Montana Bull Trout Restoration Team 1997), Montana Westslope Cutthroat Trout Restoration Plan (Montana Westslope Cutthroat Restoration Team, In preparation), Monitoring Master Plan for the Flathead Basin (Flathead Basin Commission 1985), Forest Plan: Flathead National Forest (Brannon 1985), Water Quality Data and Analyses to Aid in the Development of Revised Water Quality Targets for Flathead Lake, Montana (Stanford et al. 1997).

SUPPORT GROUPS AND DOCUMENTS: Flathead Basin Commission Biennial Report 1995-96 (Flathead Basin Commission 1997), Flathead River Drainage Bull Trout Status Report (Montana Bull Trout Scientific Group 1995a), South Fork Flathead River Drainage Bull Trout Status Report (Montana Bull Trout Scientific Group 1995b).

Subbasin.

Flathead River Drainage/Upper Columbia; work in >30 subbasins within the drainage.

Short description.

Enhance and protect native fish communities in the Flathead Basin through watershed assessments, fish passage improvements, habitat enhancement, off-site fishery restoration, and project- and watershed-level monitoring.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
	Anadromous fish	*	Construction	X	Watershed
X	Resident fish	*	O & M	*	Biodiversity/genetics
	Wildlife		Production	*	Population dynamics
	Oceans/estuaries	*	Research	*	Ecosystems

____	Climate	*	Monitoring/eval.	*	Flow/survival
____	Other	X	Resource mgmt	____	Fish disease
		____	Planning/admin.	____	Supplementation
		____	Enforcement	*	Wildlife habitat en-
		____	Acquisitions		hancement/restoration

Other keywords.

Watershed Restoration, Fish Passage, Habitat Improvement

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
9401000	Hungry Horse Reservoir Excessive Drawdown Mitigation Program	Co-Sponsor of Hungry Horse Wetlands Project, Emery Creek Restoration Project, & Watershed Level Monitoring
9101901 9648701	Confederated Salish and Kootenai Tribes - Hungry Horse Fisheries Mitigation	Co-sponsor of Dayton Creek Restoration Project and Watershed Level Monitoring, Focus Watershed Coordination relevant at Dayton Cr.
3874700	Streamnet Geographic Information Services Unit	Provide GIS and GPS support and create watershed maps
8346500	Libby and Hungry Horse Modeling Technical Analysis	Reservoir Modeling
Wildlife Trust Fund	Hungry Horse Dam Wildlife Mitigation Program	Co-sponsor of Dayton Creek Restoration Project

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Implement fish passage improvement projects in the Flathead Drainage	a	Eliminate fish passage barrier at Paola Creek
		b	Complete revegetation at 2 culvert replacements on Felix and Harris Creeks
		c	Conduct subsurface dam test to restore fall surface flows at Lion Creek or Green Gulch (if feasible)
2	Implement habitat restoration projects in onsite and offsite	a	Complete Phase 3 of Riparian and Channel Restoration at Taylor's Outflow

	areas		
		b	Implement habitat improvements concurrent with road obliteration at Emery Creek
		c	Place large woody debris in deficient (clear cut) upper reaches of North and South Fork tributaries: Big, Coal, Wheeler, Rock, and Branch Creeks
		d	Plan and complete wetlands creation on Hungry Horse Reservoir after assessment of Phase I
		e	Negotiate and begin riparian fencing on upper third of Dayton Creek drainage
		f	Complete livestock exclosure for upper 8 km of Griffin Cr.
		g	Plan and complete lake rehabilitation at Hubbart Reservoir or other lake with illegal, non-native introductions
3	Conduct project-specific monitoring and evaluation of ongoing and completed projects	a	Monitor flow regimes, fish community composition, riparian recovery, and instream habitat at Hay Creek (completed habitat and passage project)
		b	Monitor fish species composition and instream habitat in Elliott Creek (completed habitat project)
		c	Monitor use of fish ladder, fish response to channel restoration, and riparian recovery at Taylor's Outflow (ongoing watershed restoration and passage project)
		d	Monitor colonization rates of adult adfluvial cutthroat trout in 7 Hungry Horse Reservoir tributaries where passage was restored (completed passage projects)
		e	Monitor channel morphology, riparian recovery, bank stability, and fish abundance in response to cattle exclusion at Griffin Creek
		f	Monitor fish growth, species composition, and angler use at past lake rehabs on Lion, Rogers, Bootjack,, Murray, & Dollar lakes
4	Monitor watershed level fish and habitat parameters in cooperation with fish management staff and other	a	Monitor annual McNeil streambed coring and substrate scoring sites in 32 tributaries to assess trout spawning and rearing habitat quality

	BPA projects		
		b	Conduct annual adfluvial cutthroat and bull trout redd counts in 31 index tributary reaches to monitor adult runs
		c	Conduct annual cutthroat and bull trout juvenile estimates in 28 tributaries to monitor recruitment
		d	Conduct (5) river population estimates in main stem and forks of Flathead R. to assess fish abundance, species composition, and size structure
		e	Conduct annual gill net series on Flathead Lake and Hungry Horse Reservoir
		f	Collect samples for whirling disease and genetics testing on selected tributaries
5	Monitor effects of selective withdrawal at Hungry Horse Dam on Flathead River ecosystem	a	Monitor river temperatures at 6 locations in Flathead River system
		b	Complete study quantifying zooplankton entrainment through Hungry Horse Dam
		c	Quantify differences in macrozoobenthos diversity and abundance; pre- and post-selective withdrawal
		d	Quantify and compare fluvial trout and whitefish growth rates; pre- and post-selective withdrawal
6	Complete watershed assessments, site evaluations, and public scoping to identify and prioritize new projects	a	Complete watershed assessment and water conservation plan for Dayton Creek drainage
		b	Complete watershed assessments for Big, Coal, Wheeler, Rock, and Branch Creeks to identify riparian areas that have experienced extensive clear cutting
		c	Evaluate and scope future candidates for lake rehabilitation
7	Coordinate species recovery planning and operational mitigation activities with other actions in the Columbia River Drainage (i.e. flood control,	a	Track activities of bull trout and cutthroat trout restoration teams, scientific groups, and status under the Endangered Species Act; provide data, maps, text, etc. for Flathead Basin populations

	power, and species recovery actions)		
		b	Attend technical workgroup meetings, provide modeling expertise, data analysis and report products

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	6/1994	10/2000	16%
2	6/1993	11/2001	30%
3	5/1992	NA - Ongoing	13%
4	10/1988	NA - Ongoing	17%
5	5/1995	05/2001	8%
6	6/1992	11/1999	13%
7	6/1993	NA - Ongoing	3%

Schedule constraints.

Schedule changes are the norm, not the exception in implementing habitat and fish passage projects. Factors such as weather, public scoping, contracting, and permitting make this an adaptive process. Some projects proceed more quickly than expected, others more slowly. We must, therefore, move on many projects simultaneously to assure that some are completed each year. Monitoring, watershed assessment, and research portions of this program are expected to proceed as scheduled.

Completion date.

This is an ongoing mitigation program with NPPC approved, peer-reviewed (including Independent Scientific Group) implementation documents. The program was intended to be perpetual (>40 yrs). Although ongoing and proposed projects in objectives could be completed by 2001, we are constantly conducting assessments and monitoring which allow evaluation and planning of new projects within the overall program.

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel	7.61 FTE	$188,098
Fringe benefits		$56,929
Supplies, materials, non-expendable property		$65,376
Operations & maintenance	vehicles, boat and equipment maintenance, project maintenance	$18,980

Capital acquisitions or improvements (e.g. land, buildings, major equip.)		-
PIT tags	# of tags:	-
Travel	per diem, lodging, and commercial airfare	$15,124
Indirect costs	17.1% overhead	$69,255
Subcontracts	heavy equipment, trucks, genetic testing, and other contracted services	$60,493
Other		-
TOTAL		$474,255

Outyear costs

Outyear costs	**FY2000**	**FY01**	**FY02**	**FY03**
Total budget	$490,000	$500,000	$515,000	$515,000
O&M as % of total	47.0 %	46.0 %	45.0 %	45.0 %

Section 6. Abstract

In 1993, the Council adopted the Hungry Horse Dam Fisheries Mitigation Implementation Plan. This plan contains approved losses for bull trout, westslope cutthroat trout and stream habitat and describes specific measures to protect and enhance resident fish and aquatic habitat. Knotek et al. (1997) updated and formalized a plan that guides our watershed restoration efforts in the Flathead Basin, primarily through implementation of habitat and fish passage improvement projects. Current fish passage projects reconnect access to blocked spawning and rearing habitat. Habitat projects in spring creek, stream, lake, and reservoir environments emphasize passive restoration with conventional ,biotechnical, and experimental approaches. Projects address riparian degradation, major sediment and nutrient sources, channel and bank instability, and non-native fish introductions.

A specific monitoring strategy, including pre- and post-treatment sampling, is designed for each restoration project. These are combined with watershed level spawning substrate, redd count, electrofishing, and gill net monitoring series to assess direct and indirect effects of the program. Installation of selective withdrawal at Hungry Horse Dam has successfully restored normative temperatures to the Flathead River. We are assessing the effect of this change on zooplankton entrainment through the dam and on invertebrate and fish communities downstream. Offsite projects, particularly lake rehabilitations, have been successful in creating genetic reserves for native fish, drastically improving fisheries, and eliminating >source' populations for further illegal introductions. Completed and ongoing projects were identified primarily through past watershed assessments and research. These remain active components of the program to help ensure quality projects in the future.

Section 7. Project description

Note: We apologize for exceeding the page limit here. We paraphrased as much as possible, but could not shorten the description of all planned activities without omitting essential information for the reviewers.

a. Technical and/or scientific background.

In 1991, the *Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam* (Mitigation Plan) was prepared by Montana Fish, Wildlife, and Parks (MFWP) and the Confederated Salish and Kootenai Tribes (CSKT) (MFWP and CSKT 1991). This plan provided the Northwest Power Planning Council (NPPC) with documentation of fisheries and habitat losses associated with construction and operation of Hungry Horse Dam (HHD) and a flexible strategy to mitigate for these losses. It addressed six separate program measures identified in the 1987 Columbia Basin Fish and Wildlife Program Amendments. Accepted annual fisheries losses included 250,00 juvenile bull trout (DV, *Salvelinus confluentus*) and 65,000 juvenile westslope cutthroat trout (WCT, *Oncorhynchus clarki lewisi*). The Mitigation Plan also identified 124 km of critical, low gradient spawning and rearing habitat that was inundated and lost when Hungry Horse Reservoir (HHR) filled.

The *Hungry Horse Dam Fisheries Mitigation Implementation Plan* (Implementation Plan) was subsequently developed by MFWP and CSKT, adopted by the NPPC in 1993, and funded by Bonneville Power Administration (BPA). The Implementation Plan (MFWP and CSKT 1993) describes specific, non-operational measures (activities that do not affect dam operation) to protect and enhance resident fish and aquatic habitat affected by HHD. General categories of approaches include fisheries habitat enhancement and stabilization, fish passage improvements, hatchery production and fish planting, and offsite mitigation.
In 1997, Knotek et al. updated and formalized a long-term plan for identifying, prioritizing, and implementing mitigation habitat and fish passage improvement projects in the Flathead Drainage. These documents now serves as a framework for our watershed restoration efforts.

The Implementation Plan designates that HHD mitigation be conducted in the Flathead drainage. Onsite project areas include waters upstream of Kerr Dam that are directly connected to Flathead Lake or the upper Flathead River system and allow two-way movement of fish. Waters flowing into the South Fork Flathead River (South Fork) drainage upstream of HHD and waters that could be reconnected to the system through mitigation projects are also considered onsite. Offsite project areas are the remaining waters in the entire Flathead drainage that are separated from the contiguous lake and river system by physical barriers or by the lack of two-way movement of fish. In Knotek et al. (1997), priority areas for watershed restoration and preservation were developed based on habitat quality, fish community composition, and native fish abundance.

Undegraded habitat with strong populations of native species were given the highest priority. Degraded watersheds with introduced species and limited or non-existent native fish populations were lower priority areas when prioritizing habitat and passage projects.

The South Fork and most of the North and Middle Fork Flathead River drainages that lie outside national park and wilderness lands have been designated as priority areas in the mitigation program. National Park and wilderness lands are not included because they remain essentially pristine and are already protected. The entire 1.1 million acre South Fork drainage above HHD is an extremely rare and important stronghold for native fish and wildlife. It is a self-sustaining, functioning ecosystem that lies entirely within the Flathead National Forest and still contains a native fish species assemblage. Reservoir tributaries and the lower third of the drainage are managed timberlands, while the upper two-thirds lie within the Bob Marshall Wilderness Complex. Portions of the North Fork and Middle Fork that are within the United States, but outside Glacier National Park and wilderness areas, support a large proportion of the remaining adfluvial DV and WCT populations in the main stem Flathead system. Although these areas have been heavily logged in the past 40 years, most of the drainages still support native fish communities.

Fish habitat losses attributed to HHD construction include blocked access to the South Fork above the dam and flooding of the once free-flowing river system. The dam created a barrier to migration that eliminated at least 40% of the DV and WCT spawning runs from Flathead Lake. About 137 km of the South Fork and 584 km of tributary stream habitat was blocked from use by Flathead Lake fish populations. Hungry Horse Reservoir filling inundated spawning and rearing habitat in 58 km of tributary stream with gradients < 6% and approximately 66 km of the South Fork. Populations of fish isolated by the dam now use HHR as a surrogate for Flathead Lake.

In the remaining Flathead drainage, DV and WCT distribution and abundance have declined. Approximately one-third of the remaining spawning areas have been degraded by excessive sediment inputs, which have decreased egg to fry survival to < 30% (Weaver and Fraley 1991; 1993). An additional one-third of the remaining spawning reaches are inhabited by introduced fish species that may compete or hybridize with genetically >pure', native stocks.

Many onsite and offsite stream reaches have been blocked to fish passage by man-made or natural barriers. Fish passage problems in tributaries to HHR were documented following reconstruction of roads to accommodate higher water levels (Morton 1955). In the South Fork, 16% of existing WCT and DV spawning and rearing habitat above the full pool elevation was blocked by poorly placed culverts (MFWP and CSKT 1991). Natural barriers include beaver dams and sections of stream channel that intermittently become dry due to subsurface water flow. Eliminating such barriers expands the habitat available to migratory fish. Because of concerns regarding genetics, disease, and invasion of introduced species, projects involving natural fish passage barriers are evaluated on a site-by-site basis.

Since 1993, at least 15 individual habitat and fish passage projects have been completed under this mitigation program. Projects include culvert replacements, alleviation of stream dewatering, channel restoration, riparian fencing and revegetation, biotechnical repair of point sediment sources, and lake and stream rehabilitation (eradication of introduced species). We have added >25 km of high quality spawning and rearing habitat to the system for migratory DV and WCT stocks through fish passage projects alone. Techniques for enhancing benthic insect production and re-establishing vegetation in the reservoir drawdown zone (including wetlands creation) have been investigated in pilot studies. Detailed methods, results, and evaluation of these projects are described in the Hungry Horse Dam Fisheries Mitigation 1992-93 Biennial Report (Hungry Horse Implementation Group 1994) and Knotek et al. (1997). Completed and ongoing projects are also referenced throughout later sections of this document.

Concurrent with on-the-ground projects, we have maintained extensive monitoring, watershed assessment, and research components. Monitoring includes project-specific and watershed level parameters. Specific monitoring strategies, including pre- and post-treatment sampling, have been designed for each completed and ongoing project (see section 7e). These are combined with watershed level, long-term, time series indices for habitat and fish populations (section 7e) to evaluate direct and indirect effects of our projects. In 1995, a selective withdrawal system became operational at HHD. In 1995 and 1996, we quantified zooplankton distribution in the reservoir forebay and entrainment through the dam to serve as a basis for operational recommendations. Studies examining effects of temperature changes on aquatic macroinvertebrates and fish downstream of the dam are also underway. Watershed assessments are an important tool for identifying projects and limiting factors. Fortunately, past studies and habitat surveys provide extensive data needed for watershed assessments. (e.g., Read et al. 1982, Weaver et al. 1983, Brannon 1985) In most assessments, we have updated and added to existing information and incorporated survey designs of land management agencies for consistency and efficiency in data collection (e.g., incorporate the USFS R1/R4 design on National Forest streams). Others have targeted areas in which no appropriate data are available (e.g., road surveys to identify point sediment sources in South Fork tributaries). All components of this program have been carried out by personnel currently associated with the project.

Actions that require modifications to dam operation are required to achieve roughly half of the mitigation goal (MFWP & CSKT 1991). Integrated Rule Curves (IRCs) were designed to improve reservoir refill probability and reduce the occurrence of deep drawdowns to protect reservoir biological production. Minimum flows and flow ramping rates were established to improve conditions for riverine fish and food organisms (Marotz et al. 1996). Integration of power requirements, flood control, and fisheries concerns was possible using the quantitative reservoir model HRMOD. These products and activities remain important components of the mitigation program.

b. Proposal objectives.

1. Implement fish passage improvement projects in the Flathead Drainage: a) replace culvert where USFS Rd. 1638 crosses Paola Creek (Middle Fork tributary) to provide access for WCT and DV, b) restore vegetation at sites of completed culvert replacements where USFS Rd. 38 crosses Felix and Harris Creeks (Hungry Horse Reservoir tributaries), and c) design and install subsurface clay dam at test site to restore fall surface flows.

2. Implement habitat restoration projects in onsite and offsite areas: a) complete Phase III of channel and riparian restoration at Taylor's Outflow, b) implement channel improvements concurrent with road obliteration at Emery Creek, c) place large woody debris (LWD) in deficient (clear cut) upper reaches of North and South Fork tributaries: Big, Coal, Wheeler, Rock, and Branch Creeks, d) plan and complete wetlands creation on HHR after assessment of Phase I, e) negotiate and begin riparian fencing on upper third of Dayton Creek drainage, f) complete livestock exclosure for upper 8 km of Griffin Cr., and g) plan and complete lake rehabilitation at Hubbart Reservoir or other lake with illegal, non-native introductions.

3. Conduct project specific monitoring and evaluation of ongoing and completed projects: a) monitor flow regimes, fish community composition, fish abundance, instream habitat, and riparian recovery in Hay Creek (completed fish passage and habitat project), b) monitor fish species composition and instream habitat in Elliott Creek (completed habitat project), c) monitor use of fish ladder, fish response to channel restoration, riparian recovery, and habitat parameters at Taylor's Outflow (ongoing stream restoration project), d) monitor colonization rates of adult adfluvial WCT in 7 reservoir tributaries where passage was restored (completed passage projects), e) monitor channel morphology, riparian recovery, bank stability, and fish abundance in response to cattle exclusion at Griffin Creek (ongoing project), f) monitor fish growth, species composition, and angler use at past lake rehabilitations on Lion, Rogers, Bootjack, Murray, and Dollar Lakes.

4. Monitor watershed level fish and habitat parameters in cooperation with management staff and other BPA projects: a) monitor annual McNeil streambed coring and substrate scoring sites in 32 tributaries to assess trout spawning and rearing habitat quality, b) conduct annual WCT and DV redd counts in 31 index tributaries to monitor adult runs, c) conduct annual WCT and DV juvenile estimates in 28 tributaries to monitor recruitment, d) conduct (5) river population estimates in main stem and Flathead River forks to assess species abundance composition, and size structure, e) conduct annual gill net series on Flathead Lake and HHR, f) collect samples for whirling disease and genetics testing on selected tributaries.

5. Monitor effects of selective withdrawal at Hungry Horse Dam on Flathead River ecosystem: a) monitor river temperatures at 6 locations in Flathead River system, b) complete study quantifying zooplankton entrainment through HHD, c) quantify differences in macrozoobenthos diversity and abundance; pre- and post-selective withdrawal, and d) quantify fluvial trout and mountain whitefish growth rates; pre- and

post-selective withdrawal.

6. Complete watershed assessments, site evaluations, and public scoping to identify and prioritize new projects: a) complete watershed assessment and water conservation plan for Dayton Creek drainage, b) Identify riparian areas that have experienced extensive clear cutting in Big, Coal, Wheeler, Rock, and Branch Creeks in completing watershed assessments, and c) evaluate and scope candidates for lake rehabilitation.

7. Coordinate species recovery planning and operational mitigation activities with other actions in the Columbia River drainage (i.e, flood control, power, and species recovery actions): a) track activities of DV and WCT restoration teams, scientific groups, and status under the Endangered Species Act; provide data, maps, text, etc. Flathead populations and b) attend technical workgroup meetings, provide modeling expertise, data analysis, and report products.

c. Rationale and significance to Regional Programs.

Section 10.3A of the FWP details Hungry Horse resident fish mitigation. Measures 10.3A.11 & 10.3A.12 direct MFWP to implement habitat enhancement projects described in the Mitigation and Implementation Plans. The approved Implementation Plan, which includes fish and habitat loss statements, decision trees, and project prioritization criteria and rationale is a guiding framework for this program. In approving this plan, the NPPC and Independent Scientific Group encouraged "implementation of habitat improvement projects as a high priority." Montana's Fisheries Mitigation Guidelines also stress "natural fish reproduction and habitat whenever possible." Our goal is to maximize WCT and DV mitigation achieved through habitat enhancement and fish passage. Both of these species are proposed for listing under the endangered Species Act of 1973. The Flathead Basin contains some of last and best remaining strongholds for these species.

Other FWP measures address implementation of the Integrated Rule Curves (IRCs)(10.3A.3) and continued refinement of IRCs (10.3A.4). Measures 10.3A.6-8 direct BPA to fund studies to evaluate HHD operations on fish and repair of fish losses when the IRCs are violated for power or flood control.

Results of many of our projects are applicable to other programs in the Columbia River basin. Biotechnical approaches to stream habitat and riparian restoration have contributed knowledge of vegetative bank stabilization techniques. Projects also include novel or experimental approaches with wide applicability. Examples include a step-pool fish ladder completed with low-cost, natural materials and a proposed subsurface clay dam treatment to restore surface flows to dewatered streams.

d. Project history

This is an ongoing mitigation program: BPA Project 91-19-3 entitled Hungry Horse Mitigation - Habitat Improvements. It has been underway since 1993 (5 yr). Past annual

costs were $274,300, $296,579, $0, $377,925, and $368,992 for FY 1993-97, respectively (total costs 1993-97 were $1,317,796).

Previous project reports include the Hungry Horse Dam fisheries mitigation 1992-93 biennial report (Hungry Horse Implementation Group 1994), 1993-94, 1995, and 1996 kokanee stocking and monitoring reports (Deleray et al. 1995, Hansen et al. 1996, Carty et al. 1997), Hungry Horse Mitigation: aquatic modeling of the selective withdrawal system at Hungry Horse Dam, Montana (Marotz et al. 1994), Model development to establish integrated operational rule curves for Hungry Horse and Libby Reservoirs, Montana, (Marotz et al. 1996), and Fish passage and habitat improvement in the upper Flathead Basin (Knotek et al.1997).

Previous results include completion of numerous fish passage and habitat projects, an establishment of an extensive monitoring program, installation and operation of selective withdrawal at HHD, development of integrated rule curves for HHD, and offsite lake rehabilitations. From 1992-1995, monitoring of the kokanee program expended a great amount of field effort and resources. In 1995-97, CSKT assumed a large portion of the kokanee monitoring program, freeing more time for us to pursue habitat restoration projects. Highlights include work on Hay Creek, where +18 km of DV spawning/rearing habitat was reconnected to North Fork Flathead River by redefining the channel in a braided reach that was subject to seasonal dewatering. Hay Creek flows reached the North Fork during the fall DV spawning period in 1995-97. Seven fish passage projects in tributaries to HHR, proposed since 1954, were complete in 1997. In total, these projects expand available adfluvial WCT spawning and rearing habitat in HHR by 16 percent (18.5 km). Adfluvial cutthroat trout have spawned upstream of all culverts that were replaced or improved through 1997.

Several components of the Taylor's Outflow project were completed in 1994-96, including reconnection of +3 km of WCT spawning and rearing habitat to the main stem Flathead River by constructing a fish ladder. Details of the project are described in section 7c.2a. Projects at Taylor’s Outflow, Big Creek, and in the HHR drawdown zone has helped us develop biotechnical approaches for riparian restoration.

Offsite, lake chemical rehabilitations have been extremely successful in establishing popular fisheries, creating genetic reserves, directing fishing pressure away from recovering stocks, and eliminating sources for new illegal introductions. Lion Lake (treated in 1992) showed a two orders of magnitude increase in fishing pressure after treatment and has the highest pressure per acre of 509 lakes in northwestern Montana. Devine Lake treatment removed the threat posed by introduced brook trout on wilderness DV and WCT populations. Rogers Lake was rehabilitated in 1994 and now serves as a genetic reserve for Red Rocks Lake strain arctic grayling. A spawning run in excess of 1000 grayling used the improved inlet stream in 1996 and 1997.

The status of ongoing projects is described in the following section (methods). Project plans routinely change as we gain new information and feedback from peers and the

public; adaptive management is the rule on most projects. When we use experimental restoration techniques, they are applied on a small scale to evaluate their effectiveness before applications are expanded.

e. Methods.

Objective 1. Implement fish passage improvement projects. These projects assume that re-opened habitat will be recolonized by target species and that channels will remain stable, preventing formation of new migration barriers.
Task 1a. (Expected completion 10/98) In this cooperative project with the U.S. Forest Service (USFS), ~5 km of low gradient (<2.5%) spawning and rearing habitat in Paola Creek will be reopened by replacing an existing culvert which has a 1.5 m drop at its downstream end. Recent surveys indicate that the stream is fishless above the culvert, despite minimum annual flows of >3 cfs. The new culvert will be oversized to accommodate 100 yr. flows and installed on grade with a rock base and minimum sediment deposition in the stream. Genetically pure WCT and DV occur downstream of the culvert and are expected to colonize the new habitat. Concurrent with the culvert replacement, the USFS is planning reclamation of Rd 1638, which runs adjacent to the stream. Monitoring will include annual spring (WCT) and fall (DV) redd counts and establishment of a standard 150 m electrofishing section upstream of the culvert. Based on recolonization rates in other passage projects, we expect to see migratory WCT and/or DV above the culvert within 2-3 years after replacement.

Task 1b. (Expected completion 5/99) In 1994-97, culvert improvements were completed on 7 HHR tributaries to re-open 18.5 km of critical, low gradient habitat for migratory WCT (Knotek et al. 1997). We will re-establish vegetation to ensure minimal surface erosion at these sites where hundreds of cubic yards of material have been disturbed. Native vegetation, including willow sprigs, sedges and grasses, will be planted in early spring to maximize survival.

Task 1c. (Expected completion 10/2000) The objective of this project is to test an experimental treatment to reestablish surface flows in streams that flow subsurface during low water periods (late summer and fall). The technique is a technical fix for raising the water table to restore flows for spawning and rearing trout. The problem is usually caused by extensive sediment transport and deposition near the stream's mouth. This technique likely will not be applicable unless this underlying cause has been alleviated. This project stemmed from a problem in lower E. Swift Creek, where subsurface flows have frequently prevented access for spawning DV. Because a project at this site would be relatively large-scale and expensive, we decided to test the technique on a smaller stream with similar conditions. In 1997, we identified several possible test streams including Green Gulch and Lion Creek. Technical assistance was provided by BOR engineers and geologists. Piezometers were installed at upstream and downstream locations to monitor groundwater levels.

Based on data collected from piezometers, geological assessments, and logistical

constraints, one or possibly two streams will be selected for project sites. The treatment will incorporate one or more semi-impermeable clay barriers or grout injections designed to stop intergravel flow and raise the water table within the stream margins. This will cause water to flow above ground in the stream course, allowing access to migratory fish. The barrier will be constructed by trenching across the alluvial deposit (a three foot bucket width) and backfilling with clay. The trench would span the distance across the test stream's alluvial fan. Choice of potential stream sites was partially based on valley width near the mouth; we were looking for streams that run subsurface, but are confined with relatively narrow alluvial fans. It is important that the trench penetrates to the bottom of the alluvial gravel that has accumulated in the stream valley. We will import a suitable, fine semi-impermeable clay to act as the subsurface dam. Some of the material will migrate with the subsurface flow to plug interstices in the gravels. The top of the barrier will be set at ground level and imbedded with cobble so that it will not be visible from above. We will attempt to construct the plug to be self-sealing as hydraulic pressure builds behind the barrier. Once the seal forms, groundwater should rise until surface flow appears in the stream channel. If the stream migrates within the floodplain, it may cut a new route through the clay barrier. If this occurs, clay material would erode downstream to seal the new streambed. Barring a huge flood event (e.g. 1964 flood), the treatment should require little or no maintenance. If the test is only partially successful, we should see a reduction in the number of years during which the stream dries up. In the worst case scenario, the barrier would not hold and the stream would revert to its pre-treatment condition. Other (more passive) restoration techniques were considered in this project, but natural stream recovery has not been documented in several decades in many of these streams.

Objective 2. Implement habitat restoration projects.

Task 2a. (Expected completion 10/2000) Watershed restoration at Taylor's Outflow has been our most comprehensive project to date. The stream is one of the only tributaries to the main stem Flathead River. In 1992, a watershed assessment revealed that this 2.6 km spring creek (2-20 cfs) had been straightened and heavily grazed in its upper sections, resulting in extreme sediment accumulation and bank failure throughout. The fish assemblage was dominated by introduced brook trout and a low head dam prevented fish passage directly from the Flathead River. All landowners in the drainage signed conservation agreements with MFWP. In 1993, we began restoration efforts designed to restore a migratory WCT population to the stream. Riparian fences were added to all areas with livestock (~70% of drainage), willow and sedges were planted to expedite riparian recovery, and 7 cattle watering areas were constructed. In fall 1993, we treated the entire system with rotenone to eliminate introduced species and initiated WCT eyed egg plants. The treatment was only 95% successful, so brook trout are still present. In 1996, a fish ladder was installed at the system outlet, providing access for fluvial and adfluvial WCT.

After considering other alternatives, we concluded that channel reconstruction was warranted in most sections because the stream had downcut and lost its floodplain, was

extremely degraded, and was not responding quickly to riparian protection alone. We began channel reconstruction in a 300 m section at the head of the drainage in 1996. Using a design and techniques based on Rosgen (1996), we restored a meander pattern and channel geometry more characteristic of "e" type channels. Design was also largely based on an unimpacted reference reach. Large woody debris was added randomly to aid in pool formation, provide cover, and add complexity (along with now abundant overhanging bank vegetation). We also added spawning gravels to two ~ 30 m sections with appropriate slope and flow velocities. After evaluation of results, a similar design was implemented on the 500 m of stream immediately downstream. In 1998-99, we plan to complete similar channel improvements in the lower 500 m, completing restoration of the watershed. Channel work is completed using an all-terrain excavator, bobcat loaders, backhoe, and manual labor. All disturbed areas are immediately revegetated with native grasses, transplanted trees and shrubs, and sod (wetland grasses) selectively taken from other portions of the property.

Critical assumptions of this project are that planted WCT eggs will imprint on the stream, rear in improved stream habitat, survive to adulthood in the Flathead River/Lake system and return via the fish ladder to spawn. We also assume that conditions that we perceive as improved (abundant riparian vegetation, more complex instream habitat, natural channel morphology, etc.) will benefit native fish and wildlife. We have documented egg to emergence survival >25%, juvenile WCT rearing in the stream, and use of the fish ladder. In spring 1997, we documented over 60 WCT and rainbow trout using the ladder using a weir trap. We will continue to monitor fish passage at the fish ladder, fish species abundance and composition in several electrofishing sections, adult spawning runs using redd counts, and habitat conditions using substrate scoring and established cross-sections.

Task 2b. (Expected completion 11/2000) This project will attempt to restore approximately 2.7 km of degraded stream habitat in Emery Creek. Through 1996, Emery Creek supported the largest adfluvial WCT run (mean >155 redds annually) of any direct HHR tributary (excluding the South Fork). Concern has arisen over slumping banks, extensive sediment deposition, and unstable channel in the lower 2 km of the stream, which includes lower portions of WCT spawning habitat. Channel degradation appeared minor prior to 1997, when record flows apparently exacerbated the problem. The most likely cause of the problem is a bank instability and decreased channel sediment transport capacity related to a road infringing upon the stream's natural meander pattern. Essentially, the stream is unable to access its floodplain and downcutting has resulted. Logging has been limited in the upper drainage and has not led to degradation above this section.

In a cooperative, cost-share project (section 8), we propose to move the lower 2.7 km of Rd. 1048 several hundred meters away from the stream and correct channel encroachment. The road would be relocated to a bench where an old road prism exists over much of the distance. This will minimize road construction and ground disturbance. The relocated road is needed to maintain public access to the headwaters which are important for hiking, fishing, berry picking, wood cutting, snowmobiling, etc.

Preliminary watershed assessment has included habitat (R1/R4), sediment source, and fish surveys, as well as land use history. Currently, the Hungry Horse Reservoir Excessive Drawdown Mitigation program is contracting with a private consultant to complete the watershed assessment and design habitat improvements as per our review. A major emphasis will be determining which sections of the road prism to remove. Channel improvements will be implemented by our project in 1999-2000. We will monitor the stream by repeating habitat and fisheries surveys conducted over past years and in the watershed assessment. A critical assumption of this project is that restoring the streams flood plain, stabilizing slumping banks, etc. will lead to a more stable and efficient channel. In addition, we must assume that these changes will benefit aquatic and terrestrial communities.

Task 2c. (Expected completion 10/2001) Tributaries to the North and South Fork were identified as core areas for WCT and DV in the Flathead Drainage (Knotek et al. 1997). Past timber management has allowed clear-cutting right to the stream margin in certain upper portions of these watersheds, including perennial and intermittent reaches. Ground surveys have documented that large LWD in these streams is the major source of complexity, pool formation, and sediment storage. In addition, we have found that LWD recruited to streams prior to intensive logging has naturally degraded and is losing functionality. There is a tremendous amount of bedload stored behind these woody debris complexes which, once released through natural breakdown, will release this material and cause pool filling downstream.

In this project, we propose to add LWD to specific stream reaches where wood recruitment is not likely for decades. Using unimpacted reaches as reference areas, we will concentrate wood placement in headwater areas where wood recruitment from above is limited, particularly those areas where pool formation will benefit resident fish. Trees will be selected from offstream areas and placed randomly using a helicopter or all-terrain excavator. Trees will not be anchored and are intended to form natural debris jams. The USFS has implemented this technique on certain sections of the Big Creek drainage in 1996 and 1997 with desired results. The wood trapped materials in the first year and migration of the wood has been tracked using GPS. We will use continue this technique for monitoring.

Task 2d. (Completion 10/99) In 1997, we initiated a pilot wetlands project near the upper end of HHR. The project is designed to promote establishment of vegetation and benthic production in the reservoir drawdown zone, enhance wildlife habitat, and improve aesthetics. The project occurs on a ~ 40 acre >bench> just below (within 3 m of) reservoir full pool. Prior to the project, this area was often dry 11 months out of the year and was relatively barren. In 1997, we installed a temporary diversion pipe from Crossover Creek, a small, fishless stream that passes near the project area just before entering the reservoir. The 4" pipe carries water directly to the bench, where water will run into a series of shallow, natural depressions. As runoff begins this spring, a wetlands matrix should form. Two potential limiting factors will be examined: water infiltration and the duration of water supply. Preliminary soil surveys indicated that infiltration

should be minimal.

If intended results are achieved, we will add a permanent (underground) diversion pipe and enhance the wetland matrix. After surveying the project area, small elevation modifications will be used to connect and possibly expand the existing natural depressions to form a mosaic of wetted and riparian habitat and ensure that fish are not stranded. The BOR has provided an engineer who specializes in wetlands creation to assist in the design. Native sedges and immersion tolerant, wetland plants will be sprigged to expedite colonization. We will monitor benthic production and the response of native vegetation to a continuously wet environment. The wetland would increase benthic production in the reservoir as the bench is inundated for 4-6 weeks each summer. The project area also lies on the primary elk and deer winter range for the South Fork.

Task 2e. (Expected completion 10/2001) We have also initiated a cooperative project on Dayton Creek, a 3rd order, direct tributary to Flathead Lake. The drainage has been heavily impacted by logging and grazing and currently is a major source of nutrient and sediment loading for Flathead Lake (Stanford et al. 1997). Despite extensive irrigation and frequent dewatering of certain tributaries, the stream supports a weak population of WCT and infrequent DV. The upper third of the drainage, primarily owned by a Plum Creek Timber Company, is heavily logged and grazed. Riparian condition generally improves downstream as logging and grazing impacts decrease. In 1997, we began a watershed assessment that included basin-wide riparian and channel inventories, fish distribution and species composition, continuous temperature and flow measurements, and GIS mapping. Meetings with individuals and groups of landowners were also held, with a consensus supporting the project.

In 1998-99, we will pursue riparian protection, beginning with the upper drainage. In the past, Plum Creek Timber Co. has been open to various alternatives including grazing allotment changes and fencing. We have also reached agreements with private landowners for riparian fencing immediately downstream. At our request, the BOR has provided a water conservation specialist to assess the drainage and recommend water use alternatives. Landowners have expressed interest in alternatives as long as water rights are not violated.
Specific actions to protect riparian areas and conserve water will be negotiated in 1998. Future monitoring will include nutrient loading, riparian condition, bank stability, fish distribution and abundance, and instream flows.

Task 2f. (Expected completion 11/98) The upper 8 km of Griffin Creek is isolated by a natural waterfall which prevents colonization by introduced brook trout inhabiting other portions of this and connecting drainages. A strong, genetically pure WCT population inhabits this upper portion of the stream. Unfortunately, logging and grazing impacts have degraded riparian areas and the stream channel. In 1997, we cooperated with the USFS and Trout Unlimited to reduce grazing impacts. In the agreement, the USFS changed their grazing allotment to exclude cattle from upper Griffin Creek. Although an extensive fence network already exists, a minimum of 6 additional km was needed. The

new fence was installed in 1997 . However, there is still some uncertainty regarding which areas the cattle can still access because of discontinuous adjacent sections, roads, etc.. We will monitor cattle use in 1998 to identify and eliminate any remaining access points. Other monitoring will include bank stability indices, photo points, channel cross-sections, and fish abundance estimates. In this project, we safely assumed that cattle impacts were contributing to degradation of riparian and stream habitat.

Task 2g. (Completion 11/98) As mentioned previously, offsite lake rehabilitations have been an extremely successful and popular component of this program. We have documented >50 illegal fish introductions in the Flathead Basin. Introduced fish currently limit many formerly productive and native fisheries. Factors considered in selection of lakes include: impacts of illegal introduction, lake size and location, potential of fishery, public opinion (scoping), management options, presence/absence of rare or threatened species, and probability as a source or recipient for future introductions. Rehabilitations complement and reinforce an extensive education campaign against illegal fish introductions.

In the past, small (<100 acre), closed basin lakes are treated with rotenone (1.5-2 ppm) in fall just prior to ice formation. Chemicals and dead fish degrade naturally under the ice and lakes are restocked the following spring. Pre- and post-treatment monitoring typically includes: fish growth, fish and invertebrate species composition, fishing pressure, and catch rates. In FY99, we plan to treat Hubbart Reservoir, a formerly productive kokanee and trout fishery that is now dominated by stunted perch and squawfish. This impoundment of the Bitterroot River will be drawn down to minimum pool and closed off. A tributary just downstream of the dam will provide minimum flows for the river. Any dam outflow will neutralized with potassium permanganate.

Objective 3. A project-specific monitoring strategy is designed for each habitat and fish passage project. Monitoring addresses factors targeted or expected to change as a direct result of the project. Monitoring is conducted annually before and 3-5 years after project implementation. Duration and frequency will vary by project thereafter. Many examples of ongoing monitoring activities are presented in Knotek et al. (1997).

A basic tool used in all projects is a precise pre- and post-treatment photo point series. Although subjective, this is the most efficient method for monitoring recovery of riparian vegetation. In fish passage projects, fish community composition and relative abundance are assessed in established 150 m electrofishing sections above the former barrier. We also use weir traps or conduct redd counts in consistent sections to measure runs of adult, migratory stocks before and after treatment. Habitat changes are measured using a series of cross-sectional and longitudinal profiles at consistent stations with level I and II methods of Rosgen (1996). Bank stability is measured using an index developed by the USFS. Flow and temperature measurements are completed using standard techniques and contemporary equipment. In rehabilitated lakes, we use standard gill-netting, invertebrate sampling, and creel procedures. Monitoring data are analyzed using trend (correlation) analyses, t-tests, etc. where appropriate. This section has been abbreviated due to space

limitations and redundancy with next section.

Objective 4. Watershed level monitoring is a cooperative effort among this project and other MFWP fisheries staff.

Task 4a. Measurements of the size range of materials in the streambed are indicative of salmonid spawning and the quality of incubation habitat. Research in the Flathead basin has shown negative relationships between fine sediment (<6.35 mm) levels and emergence success of WCT and DV (Weaver and Fraley 1991; 1993). Field crews use a standard 15.2 cm hollow core sampler (McNeil and Ahnell 1964) and separation procedures (Shepard and Graham 1982) to collect and analyze substrate samples in known spawning habitat. Annual streambed coring sites (21) in tributaries of the North Fork, Middle Fork, South Fork, HHR, Stillwater River, and Whitefish River have been sampled for more than a decade to monitor fine sediment levels.

Task 4b. Spawning redds are excavated in tributaries by adults that have presumably returned to their natal stream to spawn. Redd counts serve as an index of migratory adult abundance. Timing, location, and size of reads are used to distinguish among species and in discriminating resident and migratory fish. We have established DV and WCT monitoring sections in tributaries of the North Fork (4 DV sections, 2 WCT sections), Middle Fork (4 DV, 2 WCT), HHR (4 DV, 10 WCT), and South Fork upstream of HHR (5 DV). Annual red counts have been completed for 4-18 yrs in these sections using consistent methods, often by the same MFWP personnel. Based on basin-wide DV counts, index sections contain > 50 % of the total redds in each drainage

Task 4c. Juvenile DV and WCT monitoring reaches have also been established to measure annual recruitment in tributary spawning and rearing streams. Population estimates are completed in 150 m sections by electrofishing and using a two-pass removal method (Zippen 1956). Monitoring reaches are located in the following drainages: North Fork (6 DV sections, 2 WCT sections), Middle Fork (2 DV, 1 WCT), South Fork tributaries of HHR (1 DV, 11 WCT), Stillwater River(1 DV, 1 WCT), and upper Whitefish River (2 DV, 1 WCT).

Task 4d. Fish abundance and size structure are assessed in larger river reaches using mark-recapture (visual snorkel) estimates. These estimates are rotated annually in consistent sections of the North Fork (3 km), Middle Fork (3 km, 3 km), and South Fork (2.4 km, 4.4 km). We also use boat electrofishing catch-per-unit-effort estimates to monitor community structure and relative population abundance in two reaches (2 km, 3 km) of the main stem Flathead River. Samples taken in these surveys are also used in age and growth analyses to monitor effects of selective withdrawal at HHD.

Task 4e. Fish communities in HHR and Flathead Lake are monitored using annual gill net series. Experimental floating and sinking gill nets are set at locations throughout the lake and reservoir in spring (4/25-5/15) and fall (10/25-11/10), respectively, to assess relative fish abundance and species composition. Nets fish designated areas and depths to

provide comparable trend data between years. At sampling sites, we set both sinking and floating experimental gill nets (overnight) perpendicular to shore. Gill nets are 38 m long and 2 m deep, consisting of panels with 19, 25, 32, 38, and 51 mm mesh sizes. The following data are collected from captured fish: abundance, total lengths and weights, stomach contents (food habits), and scales for age and growth information. Specific methods are described by Deleray (1997).

Task 4f. Whirling disease and genetic introgression are two major threats to native fish stocks in the Flathead basin. We routinely assist with sample collection for disease testing and genetic analysis. Fish samples are often collected concurrently with other monitoring activities such as electrofishing estimates. Removal of fish passage barriers also requires genetic evaluation and monitoring.

Objective 5. In fall 1995, selective withdrawal became operational at HHD. Monitoring design is based on comparison of pre- and post-implementation conditions.

Task 5a. Prior to selective withdrawal, hypolimnetic releases from the reservoir suppressed downstream river temperatures. We have installed 6 thermographs including 2 controls (natural temps above South Fork and in Stillwater River) and 5 stations longitudinally along the South fork and main stem Flathead River to track and compare river temperatures.

Task 5b. Thermal modeling results simulating the operation and effects of selective withdrawal indicated an increased incidence of zooplankton washout from the reservoir when selective withdrawal was implemented (Marotz et al 1994). This finding resulted in design modifications of the withdrawal structure to minimize zooplankton loss. In 1995, we began quantifying the vertical distribution of zooplankton in the dam forebay and washout rates in dam discharge in order to predict the best schedule for operations that will minimize zooplankton washout. We used a stratified, repeated measures design to collect samples during selective withdrawal operation in 1995 and 1996. Biweekly sampling captured the spatial and temporal variability in zooplankton abundance and distribution. Laboratory work was completed in 1997. In 1998, (FY99) we will analyze the data and complete a report to the BOR with recommendations for operation.

Task 5c. (Completion 6/99) Return of normative river temperatures should increase diversity and abundance of certain groups of macroinvertebrates. Prior to selective withdrawal, Hauer et al. (1994) designed and completed a study of macrozoobenthos in the Flathead River system. The study quantified seston drift and macroinvertebrate density and diversity at five stations throughout the year (monthly). In an ongoing study, we are repeating these methods to directly compare pre- and post-treatment data.

Task 5d. (Completion 5/2000) We assume warmer river temperatures will increase (or alter) the availability of macroinvertebrate forage for fish. Prior to operation of selective withdrawal, we collected scale samples (in winter) from rainbow trout and mountain whitefish from several sites in the lower Flathead River. These species were chosen

because of their fluvial life histories. Annual growth increments will be back-calculated for specific age classes (ages 2-4). At these ages, fish should be immature and living in the main river. In 1999, we will repeat electrofishing procedures to collect our post-treatment sample. The model of Weisberg and Frie (1987) allows direct comparison of growth after effects of good and bad growth years are removed using simple F and t tests.

Objective 6. Complete watershed assessments, site evaluations, and public scoping.

Task 6a. In 1997-98, we began an extensive assessment of the Dayton Creek drainage (section 7c.2e) including temperature and discharge measurements, land ownership, riparian and instream habitat conditions, point sediment and nutrient sources, fish community composition and distribution, and GIS mapping. In 1998-99, we will summarize these data and evaluate water conservation and land use options to complete the assessment.

Task 6b. Watershed assessments are almost complete for North and South Fork tributaries where LWD additions are planned (7c.2c). Any deficient fish survey, instream habitat, or riparian condition data will be completed in early 1998. We have used logging sale records, aerial photos, and low-level flights to identify major problem areas. In early 1998, we will ground truth and pinpoint areas where LWD recruitment is limited, reference unimpacted reaches, and plan locations (and quantities)for LWD.

Task 6c. Evaluation of lakes for rehabilitation is a continuous process that stresses public involvement and cost-effectiveness. Public scoping is critical to get feedback and make sure the public is informed about rationale for the project and properties of rotenone. Extensive public involvement also helps assure that illegal fish will not be reintroduced. Specific considerations used in selecting lakes are described in section 7c.2g.

Objective 7. Personnel in the mitigation program have extensive experience with fish species proposed for ESA listing (DV and WCT) and Columbia River system modeling. This expertise frequently warrants staff involvement in advisory and editorial roles.

Task 7a. Montana is currently assessing and planning recovery actions for DV and WCT through Westslope Cutthroat and Bull Trout Recovery Teams and Scientific Groups. Our region contains the strongest remaining populations of these species, so we are actively involved in protection and recovery measures.

Task 7b. Computer modeling using Montana's HRMOD and system models (BPA and ACOE) allows for assessment of biological effects of system operation. Results are used to recommend operational strategies to improve conditions for biological production, particularly in HHR.

f. Facilities and equipment.

All offices, equipment, and facilities are located at the MFWP regional headquarters in Kalispell, Montana. This 5 acre complex, built in 1990 , houses ~55 MFWP employees in addition to our project personnel. Facilities include several boat sheds, a machine shop, wet laboratory, field prep room, storage buildings for project equipment, and office space for all staff. Other specialized equipment includes a 22 ft boat with inboard motor, 14 ft boat with outboard motor, Bobcat skid-steer loader with backhoe (shared with Libby Dam Mitigation Project), backpack and bank electrofishing units, GPS units, laser level and surveying equipment, microscopes, cameras, and project vehicles from the MFWP motor pool. Fisheries management and Parks Divisions have other specialized equipment available when occasionally needed for projects: boom trucks, dump trucks, trailers, additional boats and vehicles, etc.

We have sufficient computer and communications equipment. In addition, our office houses the Geographic Information Services Unit (GIS support) for the state. This group frequently assists our project in GIS, GPS, and mapping applications. They also manage the Montana River Information System (MRIS).

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Section 8. Relationships to other projects

The Hungry Horse Reservoir Excessive Drawdown Mitigation Program (Excessive Drawdown) is a closely related and cooperative BPA funded project (project 9401000) . Although focused on predation of juvenile (outmigrating) cutthroat and bull trout in the lower Flathead River system, this project has additional habitat restoration and watershed level monitoring components. Two ongoing habitat restoration projects in the South Fork Drainage are co-sponsored by this program. The first involves channel improvements on Emery Creek (see 7e.2b). In FY 1998, the Excessive Drawdown Program will fund a private consultant to evaluate the watershed and design a restoration plan to be implemented by our project in 1999-2000. Cost share and personnel have been provided for the wetlands creation project in the HHR drawdown zone (see 7e). The Excessive Drawdown project is also investigating how the operation of selective withdrawal at HHD influences the distribution, abundance, and movements of introduced predators and native fish. This complements our investigation of selective withdrawal effects on river temperatures, invertebrates, and fish growth. Watershed level monitoring activities assisted by Excessive Drawdown personnel include bull trout redd counts and gill-netting above HHD.

Projects 9101901 and 9648701, administered by the Confederated Salish and Kootenai Tribes (CSKT), also collaborates on certain activities. Because CSKT manages the south half of Flathead Lake and tribal lands encompass the lower Flathead Drainage, we cooperate on several interjuristictional projects. These include all monitoring, Focus Watershed planning, and management activities involving Flathead Lake and certain tributary streams. Dayton Creek restoration is one ongoing project that we have collaboratively designed and begun to implement with CSKT and several other groups (7c.2e). In the preliminary watershed assessment, we completed basin-wide fish distribution and abundance surveys, installed thermographs, completed maps using

MFWP's GIS support system, and made some of the initial landowner contacts. Personnel from CSKT also made landowner contacts, organized landowner meetings, and contracted a complete riparian survey for the drainage. Local conservation districts provided land ownership and water right information. The University of Montana's Flathead Lake Biological Station (Flathead Biological Station) provided water quality and nutrient loading information.

As mentioned above, we often benefit from the Geographic Information Services Unit (Streamnet project 3874700) housed in neighboring offices. This GIS support group integrates GPS locations and provides land ownership, land use, species distribution, etc. layers that assist in creating detailed watershed maps. These maps are essential in planning projects and have enabled us to look at the Flathead System with much greater detail.

The majority of our projects include cost-shares and collaborative efforts with other agencies. For example, we have used the BOR's Technical Assistance Program when engineering support was needed on the completed Hay Creek project and ongoing HHR wetlands project. Essentially, we receive engineering and other assistance without cost to our project. The BOR has also co-sponsored selective withdrawal monitoring since 1995. We also frequently co-sponsor projects with the U.S. Forest Service when projects occur on their land. Examples include the completed culvert improvements on HHR tributaries, Griffin Creek fencing project, and Lion Lake chemical rehabilitation. In the Emery Creek restoration project, MFWP, Flathead National Forest, and Flathead Common Ground (a consensus building group made up of environmental, timber management, multiple-use, and agency representatives) are involved. Other groups that have routinely cooperated on projects include Trout Unlimited, local Conservation Districts, Montana Conservation Corps, and the Flathead Biological Station. The Flathead Biological Station has collected useful water quality, invertebrate, and other ecological data throughout the Flathead Lake and River system. We have incorporated these data, the expertise of station personnel, and contracted studies in past and current projects.

Habitat and fish passage projects typically require Montana Stream Preservation Act (124) permits, Temporary Water Quality (turbidity) Exclusion (3A) Permits, Army Corps of Engineers 404 Permits, and Environmental Assessments. Cooperative relationships with land management agencies often expedites permitting and project implementation.

Section 9. Key personnel

BRIAN MAROTZ

Fisheries Program Officer (0.10 FTE)
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Kalispell, Montana 59901
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Education

Master of Science B Fisheries Management
Louisiana State University - Baton Rouge, Louisiana.
Estuarine Biology

15 Credits: Gulf Coast Research Institute
Ocean Springs, Mississippi.
Marine Science

Bachelor of Science B Biology (Aquatic Sciences)
University of Wisconsin - Stevens Point, Wisconsin.
Freshwater Biology

16 Credits: S.E.A. Semester at Sea, Boston University
Woods Hole, Massachusetts
Marine Biology

Professional experienceexperience

1991-Present Fisheries Program Officer, Montana Fish, Wildlife & Parks
Kalispell, Montana
Duties: Supervise Special Projects Office, Hydropower Mitigation and Focus Watershed Programs. Oversees all BPA sponsored projects in the Upper Columbia Basin of Montana. Directly supervise principal investigators and represents MFWP at CBFWA resident fish managers and Members meetings.

1989 B *1991* Fisheries Biologist, Montana Fish, Wildlife & Parks
Kalispell, Montana
Duties: Hungry Horse Reservoir Research, Develop Hungry Horse Mitigation Program, Computer Modeling Flathead and Kootenai Drainages, Develop Integrated Rule Curves (IRCs) for Montana Reservoirs.

1985 B *1989* Fisheries Biologist, Montana Fish, Wildlife & Parks
Libby, Montana
Duties: Libby Reservoir Research, Kootenai Instream Flow Project, Computer Modeling Flathead and Kootenai Drainages, Develop Integrated Rule Curves (IRCs) for Montana Reservoirs.

1984 B *1985* Research Associate, Louisiana State University - Baton Rouge, Louisiana
Duties: Estuarine Research to control salt water encroachment to Estuarine Marsh on the Sabine National Wildlife Refuge. Developed Operating Plan for Water Control Structures to Allow Migration of Catadromous Fish and Crustaceans

Publications

Pertinent Publications Listed in this Document

Awards

1994 Governor's Award for Excellence in Performance as an Employee of the State of Montana

1994 Director's Award for Excellence as an Employee of Montana Fish, Wildlife & Parks

1989 Certified Fisheries Scientist
American Fisheries Society

W. LADD KNOTEK

Implementation Biologist and Principal Investigator, FTE=1.0
Montana Fish, Wildlife and Parks
490 N. Meridian Road, Kalispell, MT 59901
phone: (406) 751-4542
email: ladd@digisys.net

DUTIES: Manages daily operations of the project including project prioritization, project design and implementation, public scoping, permitting, supervision of technicians, and scheduling.

EDUCATION:

M.S. in Fisheries Biology - 1995
Virginia Polytechnic Institute and State University
Honors: EPRI Fellowship, AIFRB Research Assistance Award, AFS Skinner Memorial Award, GPA: 4.0

B.S. in Biology - Fisheries/Wildlife Emphasis, Chemistry minor - 1992
University of North Dakota
Honors: Arthur Anderson Award/Scholorship, Robertson Achievment Award, Behringer Award/Scholorship, Paur Award/Scholoarship, The Wildlife Society Scholoarship, Phi Beta Kappa, GPA:4.0, Graduated Summa Cum Laude

ADDITIONAL TRAINING:

* Fish Otolith Preparation and Microstructural Examination, Virginia Dept. Of Game and Inland Fisheries, Instructor: Mike Duval. Lynchburg, VA, November, 1995.
* Applied Fluvial Geomorphology, Wildland Hydrology Consultants, Instructor: Dave Rosgen. Pagosa Springs, CO, June, 1996.
* River Morphology and Applications, Wildland Hydrology Consultants, Instructor: Dave Rosgen. Pagosa Springs, CO, July, 1997

RELEVANT EXPERIENCE:

* Department of Fisheries and Wildlife Sciences, Virginia Tech
Sept 1995 - Dec 1995 Supervisors: Dr. John Ney and Trent Sutton
Research assistant for striped bass recruitment study at Smith Mountain Lake

Virginia.
* Department of Fisheries and Wildlife Sciences, Virginia Tech
Apr 1993 - Aug 1995 Supervisor: Dr. Donald Orth
Research assistant for field and laboratory studies involving stream fish recruitment and reproductive ecology.
* Biology Department, University of North Dakota
May 1991 - March 1993 Supervisor: Dr. Isaac Schlosser
Research assistant/lab technician for several studies encompassing fish and invertebrate ecology in streams and lakes
* Biology Department, University of North Dakota
Jan 1991- Apr 1991 Supervisor: Scott Hegrenes
Technician for research study involving channel catfish population dynamics.

PROFESSIONAL SERVICE AND AFFILIATIONS:

American Fisheries Society: 1993-present. 1995-96 Professionalism Committee, 1994-95 Award of Excellence Selection Committee, 1994-95 Southern Division Membership Committee, 1995 VA Tech Chapter President, 1994 VA Tech Chapter Vice-President.

American Institute of Fisheries Research Biologists: 1995-present. Associate Member.

EXPERTISE: Design and implementation of fish passage and habitat restoration projects. Extensive experience with sampling design and monitoring approaches.

RECENT PUBLICATIONS AND REPORTS:

Knotek, W.L. and D.J. Orth. In press. Survival for specific life intervals of smallmouth bass, *Micropterus dolomieu*, during parental care. Environmental Biology of Fishes.

Knotek, W.L., M. Deleray, and B. Marotz. 1997. Fish passage and habitat improvement in the upper Flathead River basin. Montana Fish, Wildlife, and Parks, Kalispell, Montana. Prepared for Bonneville Power Administration. 60 pp.

Carty, D., W. Fredenberg, L. Knotek, M. Deleray and B. Hansen. 1997. Hungry Horse Dam Mitigation: kokanee stocking and monitoring in Flathead Lake. Annual progress report-1996. BPA project numbers 9101901, 9101903, and 9101904. Submitted to Bonneville Power Administration.

TOM WEAVER
Fisheries Monitoring and Research Specialist, FTE: 0.6
Montana Fish, Wildlife and Parks
490 N. Meridian Road, Kalispell, MT 59901

phone: (406) 751-4542

DUTIES: Designs and coordinates watershed level monitoring activities. Represents project on Montana Bull Trout Scientific Group

EDUCATION:

B.S. in Wildlife Biology (Aquatic) - 1980
University of Montana

EXPERIENCE:

Employed by Montana Fish, Wildlife and Parks (MFWP) since 1977. Through various technician and researcher positions, helped develop basin-wide fisheries monitoring program for the Flathead Drainage.

In 1984-86, was employed by Montana Cooperative Fisheries Research Unit, Montana State University. Conducted independent research on the effects of fine sediment on embryo survival to emergence for westslope cutthroat and bull trout.

Past and Ongoing activities include:

* Senior bull trout researcher for MFWP.
* Member of Montana Bull Trout Scientific Group
* Advisor for Montana Bull Trout Recovery Team
* Member of logging Best Management Practices (BMPs) audit team since 1987
* Cooperative researcher and/or contracts with Flathead National Forest, Glacier National Park, Flathead Basin Commission, and Montana Department of Natural Resources and Conservation
* Regularly consult with USFWS during bull trout ESA listing process.

EXPERTISE: Ecology and status of native salmonids in the Flathead Basin, the effects of forest management activities on native salmonids, and development and implementation of fisheries monitoring activities in the Flathead Basin.

PUBLICATIONS AND REPORTS:

Weaver, T.M. and J.J. Fraley. 1993. A method to measure emergence success of westslope cutthroat trout fry from varying substrate compositions in a natural stream channel. North American Journal of Fisheries Management 13:817-822.

Weaver, T.M. and J.J. Fraley. 1991. Fisheries habitat and fish populations. Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program, Flathead Basin Commission, Kalispell, Montana. 47 pp.

Weaver, T.M., J.J. Fraley and P.J. Graham. 1983. Fish and habitat inventory of streams in the Middle Fork of the Flathead River. Flathead River Basin Environmental Impact Study. Prepared by Montana Department of Fish, Wildlife, and Parks, Kalispell, Montana for the Environmental Protection Agency.. 229 pp.

Section 10. Information/technology transfer

Project results will be published in reports to BPA and, where applicable, peer reviewed journals. Quarterly progress reports are sent to all interested agency and citizen groups. Results of the program are frequently presented at professional meetings within and outside MFWP, and in the public arena through invited presentations, newsletters, and news coverage. MFWP currently supports a state-wide rivers database with information on streams, fisheries, species distribution, etc. This database is administered from within our office and is accessible through MFWP's Internet web site.

In addition to annual and quarterly reports, project summaries including background, problem statement, restoration options, actions, and monitoring are completed for each fish passage and habitat project. For instance, summaries for 17 completed and ongoing projects are presented in Knotek et al. (1997). We are currently preparing a document which presents results of watershed level monitoring activities since 1988. We will also prepare a report in 2000 that summarizes monitoring and research activities associated with selective withdrawal.